Workbook 4:
Using the Huntsville Operations Support Center (HOSC) Display Generation and Operation Applications

HOSC Training Division

August 1999

National Aeronautics and
Space Administration

George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

Workbook 4:
Using the Huntsville Operations Support Center (HOSC) Display Generation and Operation Applications

HOSC-WKBK-2070

October 1999

Prepared in support of:
NAS8-44000

Prepared by:
HOSC Training Team

Prepared for:
Mission Systems Division
Mission Operations Laboratory
Science and Engineering Directorate
Marshall Space Flight Center

Welcome

Welcome to Huntsville Operations Support Center (HOSC) training provided by the HOSC Training Team (HTT).

If you are interested in scheduling additional training, submit a training request form via the Internet. The homepage can be accessed through a secure connection at:

https://red-dwarf.msfc.nasa.gov/webdoc/training/htt.html

Another option is to contact the HOSC Training Coordinator, Cindy Jorgensen, at (256) 461-4927.

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Workbook Overview

The majority of the workbooks are designed to be self-paced requiring very little assistance from an instructor. The following table lists the workbooks and their associated course number:

Workbook Numbering System

Workbook Number	Title	Associated Course
Workbook 1	HOSC End-User Software Training	HOSC-1000 HOSC-1010 HOSC-1020 HOSC-1030
Workbook 2	Using the Databases	HOSC-2050
Workbook 3	Using the Exception Monitor Application	HOSC-2060
Workbook 4	Using the Display Generation and Operation Applications	HOSC-2070
Workbook 5	Using the Computation Generation and Operation Applications	HOSC-2080
Workbook 6	Using the Scripting Applications	HOSC-2090
Workbook 7	Using the NRT Data Request Applications	HOSC-2100

Workbook Numbering System (Continued)

Workbook Number	Title	Associated Course
Workbook 8	Using Applix	HOSC-2110
Workbook 9	Using FrameMaker	HOSC-2130
Workbook 10	Using Electronic Mail	HOSC-2140
Workbook 11	Using the Payload Information Management System (PIMS)	HOSC-2150 HOSC-2160
Workbook 12	Using the Pixmap Editor	HOSC-2170
Workbook 13	Using the Ground Support Equipment Packets Application	HOSC-2180
Workbook 15	Using the End-User Command Applications	HOSC-2120
Workbook 22	Workstation Overview and General Purpose Utilities Training	HOSC-1040
Privileged Applications		
Workbook 16	Using the Privileges within the Database Applications	HOSC-3000
Workbook 17	Using the Command System Management Application	HOSC-3010
Workbook 18	Using the User Configuration Management Application	HOSC-3020
Workbook 19	Using the System Monitor and Control Applications	HOSC-3030 HOSC-3040
Workbook 20	Using the Data Packet Generator Application	HOSC-3050
Workbook 21	Using the Database Monitor and Control Application	HOSC-3060

This workbook covers course:

HOSC-2070 - Using the Display Generation and Operation Applications

This course will provide the trainee with the information necessary to create customized displays using the Display Generation application and view space vehicle telemetry data using the Display Operation application.

Workbook Layout

The workbooks include a welcome section that details how the document is divided into modules as well as what is contained within each module. The modules include a discussion of the main topic of the module, a step-by-step "Try It..." and review questions. Modules have been included that "put it all together" and provide exercises to reinforce what you have learned.

This particular application is provided to assist you, the user, in creating customized displays to view space vehicle telemetry data. This course will provide thorough introduction to the purpose and structure of the software and will set you on a path toward understanding the applications and mastering the manipulation of them.

This workbook and the accompanying course are divided into six modules. At the end of each module, you are presented with a small number of review questions which allow you to test yourself on the important points covered in that module. In addition, several modules also contain scenarios followed by step-by-step "Try It..." exercises which will give you hands-on experience using the Display Generation/Operation software.

Each module features an exercise which will apply the skills you acquire during the course The six modules include:

    Module 1: *An Introduction to Display Generation and Display Operation*
    Module 2: *Using Primitive Objects in Your Displays*
    Module 3: *An Overview of Output Objects*
    Module 4: *Taking Control with Input Objects*
    Module 5: *Using Advanced Features*
    Module 6: *Putting Your Skills to Use*

Given the extensive technical requirements, extreme effort has been taken to make the software as intuitive and user-friendly as possible. Hopefully, your experience with the software will be rewarding, and you'll find it satisfies your individual needs.

Contents

List of Figures

Workbook Objectives

At the completion of this workbook, you should be able to:

- Identify the drawing tools and demonstrate the use of each one
- Build a custom display using primitive, output, and input objects
- Bulk generate a display with MSID text fields
- Create a custom pulldown menu
- Generate a report detailing every aspect of your display
- Define an operation startup list

Module 1
Introduction to Display Generation and Display Operation

The Display Generation application provides you with the capability to create, modify, and save customized displays which you build to view space vehicle telemetry data. The application provides drawing tools that allow you to create various objects on a display. These objects may include plots, data fields, pie charts, pushbuttons, etc. Objects may be built to display data, enter values, as well as send commands.

The **Display Generation** main window is both your drafting table and your configurable electronic grid paper. Drawing tools are provided which permit you to construct sophisticated graphic screens to display telemetry data, initiate commands, and start scripts and computations. The Drawing Tools palette can be a part of the **Display Generation** main window or remain a separate entity.

The drawing tool palette provides 24 tools for building a display. The palette default location is on the main window. The tools allow you to draw shapes, such as lines, rectangles, squares, ellipses, and circles. Tools are also available for building input and output objects that display telemetry parameters or execute scratchpad line (SPL) directives such as uplinking commands or starting computations.

Once displays are built, Display Operation is the application you use to look at data on the displays. You can also uplink and update commands, start and stop displays, update variables, etc. Through displays, you can view telemetry values and graphical representations of data (i.e., circles, lines, and pixmaps). Numerical values may be plotted on various graphs or on a scale. Buttons and graphic objects can be used to represent various states. Colors are used to indicate caution and warning limit violations. For controlling these displays, the application provides options to change the data mode, the database version, the time reference, and to turn limit sensing and status characters on or off.

Tip: Only one display can be opened at a time within a single Display Operation application. If you wish to open two displays simultaneously, you must launch two separate Display Operation applications. If you attempt to open a second display within a single Display Operation application, the display invoked will replace the one shown in the work area.

Prerequisites

Before beginning Display Generation or Display Operation, you must have a Huntsville Operations Support Center (HOSC) account and should have completed the Workstation Overview and General Purpose Utilities Training, course number HOSC-1040.

Starting Display Generation

To invoke the Display Generation application from the **Launchpad**, click on the **Generation** menu and then click on **Display Generation** (see Figure 1-1, Launchpad Generation menu).
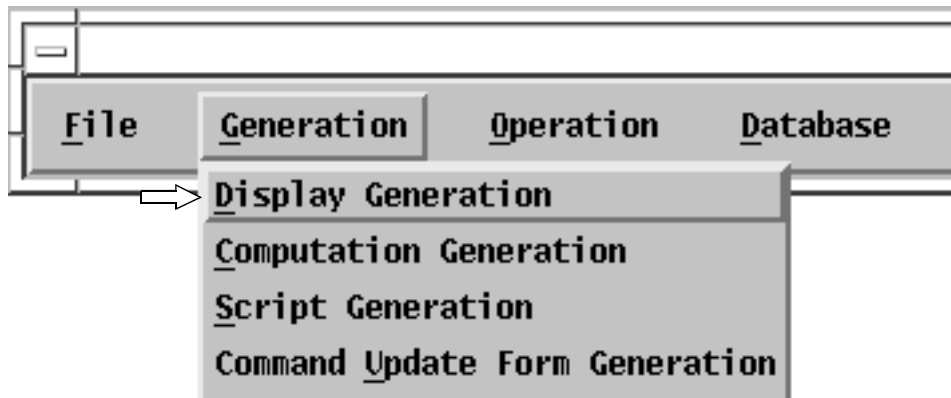

Figure 1-1, Launchpad Generation menu

Starting Display Operation

The Display Operation application is started from the **Launchpad** by clicking on the **Operation** menu and selecting **Display Operation** (see Figure 1-2, Launchpad Operation menu).
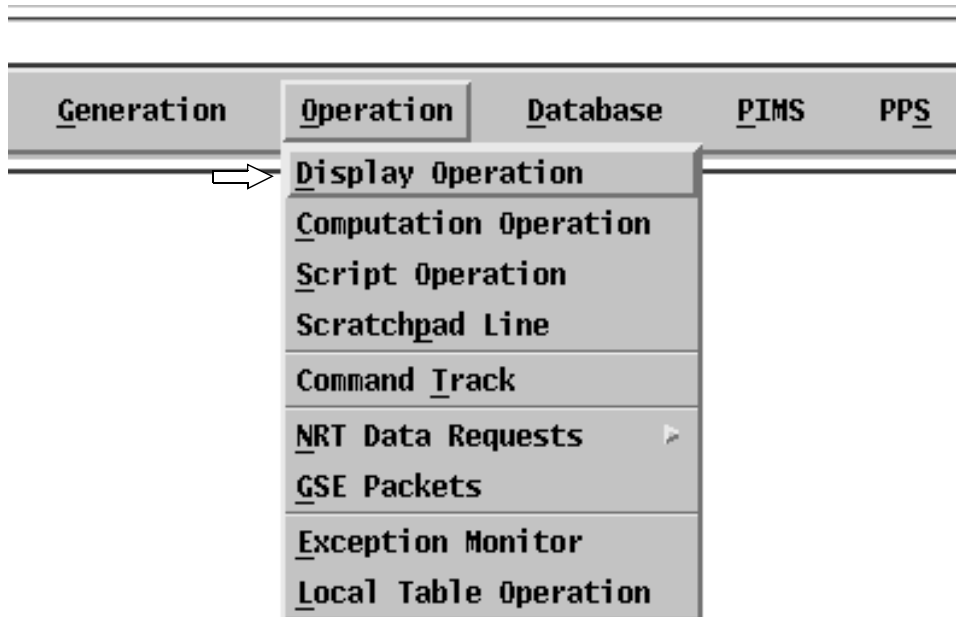

Figure 1-2, Launchpad Operation menu

Review Questions

Instructions

Indicate the answers for each question below. The correct answers are given immediately following the questions.

1. What application is used to build displays, in order to view space vehicle telemetry data?

2. What application is used to look at data on the displays?

3. Name at least three functions you can do with displays.

4. The drawing tool palette provides how many tools for building a display?

5. How many displays can you open within a single Display Operation application?

Review Answers

1. Display Generation

2. Display Operation

3. Display telemetry data
   Initiate commands
   Start/stop scripts
   Start/stop computations

4. 24

5. One

Module 2
Using Primitive Objects in Your Displays

Creating a display will often require the use of the primitive object drawing tools. Primitive objects include geometric shapes such as lines, rectangles, squares, ellipses, and circles. A text tool is also included for labelling purposes.

Primitive objects can function either as static items (which can be used as building components) or as dynamic objects which change in response to assigned parameters. These objects are similar to the drawing tools found in commercial drawing applications.

Before we begin discussing the use of the primitive object tools, let's customize the look of your screen to your viewing preferences. Display Generation allows you to hide your tools altogether, place them on the main screen (the default mode which you are now viewing), or place them on a moveable dialog box. To change the way your tools appear:

1. From Display Generation's **View** menu, select **Reconfigure Drawing Tools**.

2. A cascade menu appears. From this menu, select whether you wish to show your tools on the main window, a dialog box, or to hide the tools.

Now let's resize the display so that we have a larger design area:

1. Place your cursor on the lower right-hand corner of the window.   The cursor changes to indicate that you may resize the application window. Drag the application window down and to the right to enlarge it.

2. Now you should notice two perpendicular white lines that intersect at a black box. These lines define the horizontal and vertical limits of the display. Click and drag the black box to resize the display to the desired size.

If you are happy with your design environment, you can begin working with primitive objects. The **Display Generation** tool palette includes 11 primitive object tools (see Figure 2-1, Primitive Object Drawing Tools).
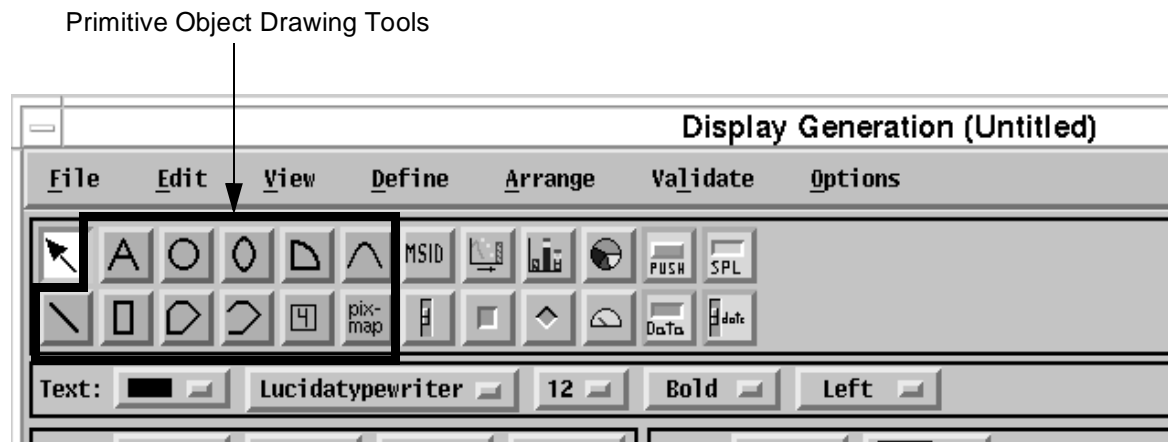
Primitive Object Drawing Tools

Figure 2-1, Primitive Object Drawing Tools

These primitive object tools appear on light green buttons. To use one of the tools, simply click on it and your cursor can be used in the main drawing area to create the selected object. To create multiple instances of an object without having to re-click the tool button, double-click the tool button to enter "multiple drawing" mode.

The following sections illustrate how to create each of the primitive objects.

The **Text Tool** allows you to create text objects. Text can be used for purposes such as column titles, paragraphs, or phrases.

To Create Text Objects:

This tool requires you to click, type, and click again.

1. Click on the **Text Tool**. When you move the cursor into the display area, the cursor changes to a ⊹.

2. Click where you wish the text to begin. A blinking I-beam insertion bar will appear.

3. Begin typing.

4. Click outside the created text to complete the text object creation.

The **Circle Tool** allows you to create circles.

To Create a Circle:

This tool requires you to click, drag, and release.

1. Click on the **Circle Tool**. When you move the cursor into the work area, the cursor changes to a ✛.

2. Move the cursor into the display area, press and hold down the left mouse button. The point at which you press the left mouse button defines the center of the circle.

3. Move the mouse diagonally in any direction. The point at which you release the mouse button will define the size of the circle.

   To resize a circle, grab a selection handle and drag the circle to the desired size. Any handle you select will enlarge the circle proportionally. The pointer changes shape to indicate that you are in the resize mode.
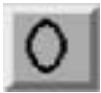
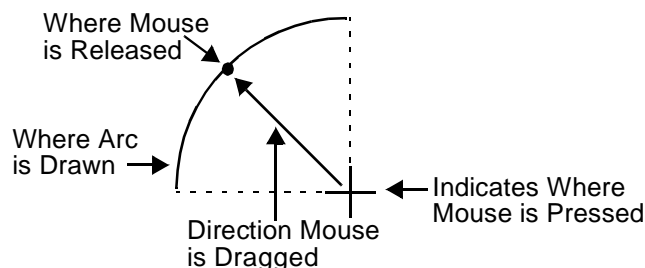The **Ellipse Tool** allows you to create various size ellipses.

To Create an Ellipse:

This tool requires you to click, drag, and release.

1. Click on the **Ellipse Tool**. When you move the cursor into the work area, the cursor changes to a ✛.

2. Move the cursor into the drawing area, press and hold down the left mouse button. The point at which you press the left mouse button defines the center of the ellipse.

3. Move the mouse in any direction to define the width and height of the oval. The point at which you release the mouse button will define the size of the oval.

The **Quarter Arc Tool** allows you to draw a 90° elliptical quarter arc. The direction of the arc is based on the direction the mouse is dragged.

To Create a Quarter Arc:

This tool requires you to click, drag and release.

1. Click on the **Quarter Arc Tool**. When you move the cursor into the work area, you should see ✛.

2. Move the cursor into the drawing area, press and hold down the left mouse button. The point at which you press the left mouse button defines the 90° point for the quarter arc.

3. Move the mouse in any direction within a quadrant to define the direction of the arc. The point at which you release the mouse button will define where the arc is drawn.
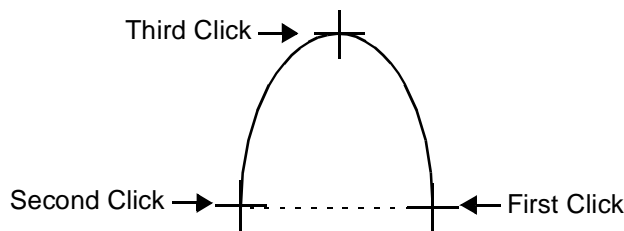
The **Arc Tool** allows you to draw arcs that are half an ellipse and that can have their straight edge rotated to any angle desired.

To Create an Arc:

This tool requires that you click the mouse three times.

1. Click the first time to mark the beginning of the arc.

2. Click the second time to mark the end of the arc.

3. Click the third time to determine the curve of the arc.

The **Line Tool** allows you to create lines of various lengths, widths, and styles. This tool also allows you to determine whether arrows will appear at the beginning or end of these lines.

To Create a Line:

This tool requires you to click, drag, and release.

1. Click on the **Line Tool**. When you move the cursor into the work area, the cursor changes to a +.

2. Move the cursor into the drawing area, press and hold down the left mouse button. The point at which you press the left mouse button is the beginning of the line.

3. Move the mouse in any direction to increase the length of the line. The point at which you release the mouse button will define the length and direction of the line.

4. To resize a line, press and hold on a selection handle with the left mouse button and drag the line to the desired length.
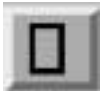
The **Rectangle Tool** allows you to create rectangles of various sizes.

To Create a Rectangle:

This tool requires a click, drag, and release.

1. Click on the **Rectangle Tool**. When you move the cursor into the work area, the cursor will change to a ✛.

2. Move the cursor into the drawing area, press and hold down the left mouse button. The point at which you press the left mouse button defines a corner of the rectangle.

3. The point at which you release the mouse button will define the size of the rectangle.

The **Irregular Closed Polygon Tool** allows you to draw shapes that are composed primarily of angles and straight lines. A polygon can have as many sides as you want. The system closes polygons created with the close polygon tool by connecting the first and last points.

To Create an Irregular Closed Polygon:

This tool requires multiple single clicks and a double-click.

1. Click on the **Irregular Closed Polygon Tool**. When you move the cursor into the work area, the cursor will change to a ✛

2. Click to begin the first line segment; then click at each point where you wish a line segment to end.

3. Double-click on the last point and the software will connect the last point and the first point to complete the irregular closed polygon.

The **Irregular Open Polygon** tool allows you to draw shapes that are composed primarily of angle and straight lines. The difference between the irregular open and the closed polygon is that the closed polygon has a line connecting the first and last points and the open one does not.

To Create an Irregular Open Polygon:

This tool requires multiple single clicks and a double-click.

1. Click on the **Irregular Open Polygon Tool**. When you move the cursor into the work area, the cursor changes to a ✛.

2. Click to begin the first line segment then click at each point where you want a line segment to end.

3. Double-click on the last point to complete the irregular open polygon.

The **Regular Polygon Tool** allows you to draw equilateral polygons. A regular polygon can be created to have from three to eight equal sides.

To Create a Regular Polygon:

This tool requires a click, drag, and release.

1. There are two methods of initiating a regular polygon when the tool palette is on the dialog box:

    A. Click on the **Regular Polygon Tool** then click on ▲ or ▽ select the desired number of sides.

    B. Click on ▲ or ▽ select the desired number of sides and then click on the **Regular Polygon Tool**.
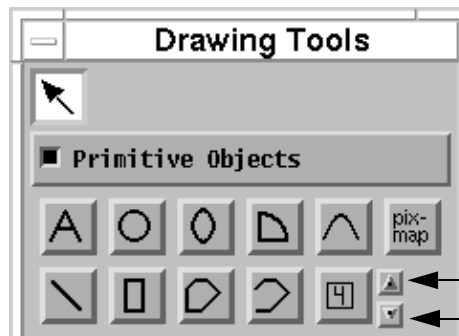
Click on Arrows
To Change the
Number Of Sides

OR

When the tool palette is on the main window, you can click on the regular polygon tool with the right mouse button and select the number of sides.

Note: This method is also available from the Drawing Tools dialog box.

When you move the cursor into the work area, the cursor will change to a ✚.

2. Move the cursor into the drawing area, press and hold down the left mouse button. The point at which you press the left mouse button defines the center of the polygon.

3. The point at which you release the mouse button will define the size of the regular polygon.

The **Pixmap Tool** allows you to draw a pixmap object. Once the object is drawn, an image can be assigned to it. The image (pixmap) is either created using the Pixmap Editor software available from the Launchpad **Utilities** menu or transferred to the local workstation. Pixmaps used within a display are located on the local workstation and can be defined as static or dynamic.

To Create a Pixmap Object:

This tool requires you to click, drag, and release.

1. Click on the **Pixmap Tool**. When you move the cursor into the work area, the cursor changes to a +.

2. Move the cursor into the drawing area, press and hold down the left mouse button. The point at which you press the left mouse button is a corner of the pixmap.

3. Move the mouse in any direction to increase the size of the object. The point at which you release the mouse button will define the size of the pixmap object.

To Assign Object Attributes:

Once you have created a primitive object, you must assign specific attributes to it in order for it to function as needed when you operate the display. You can assign object attributes in one of three ways:

1. Double-click on the object whose attributes you wish to edit.

   OR

2. Select the object you wish to edit using the arrow selection tool. Then, while you cursor is inside the work area of the main window, click your right mouse button to initiate a popup menu. From this menu, select **Set Object Attributes...**.

   OR

3. Select the object whose attributes need editing. Select the **Define** menu, and then choose **Set Object Attributes...**.

Either of these methods will invoke a dialog box which allows you to edit the attributes for the selected object. The contents of this dialog box will vary depending on the type of primitive object whose attributes you are editing.

Now that you have the information needed to create these primitive objects, let's create a simple display using some of the primitive objects. Refer to the sections earlier in this module for explicit directions for each object.

Exercises

Instructions

The following "Try It" allows you to build a display using the primitive object drawing tools. Carefully read and complete each step.

Try It...

1. Start the Display Generation application. From the Launchpad's **Generation** menu, select **Display Generation**.

2. Take a minute to look at the work area. Resize the display (not the window) by clicking on the boundary handle and dragging it. Release it at the desired size.

3. Create a rectangle by clicking on the rectangle tool on the tool palette.

4. Click and drag the mouse in the **Display Generation** work area, and release the mouse button when the rectangle is the desired size.

5. Change the rectangle's fill color by clicking on the **Fill:** option menu button and selecting a different color.

6. Change the fill pattern from solid to stripe by clicking on the pattern option menu button.

7. Create an ellipse by clicking on the ellipse tool.

8. Click and drag the mouse in the **Display Generation** work area, and release the mouse button when the ellipse is the desired size and shape.

9. Change the ellipse's fill color by clicking on the **Fill:** option menu button and selecting a different color.

10. Change the fill pattern from one stripe pattern to another by clicking on the pattern option menu button.

11. Select the ellipse by clicking on it with the left mouse. Move the ellipse until it sits on top of the rectangle by clicking with the middle mouse button on the selected circle and dragging it to its new location. Make sure the ellipse fully overlaps the rectangle so that you can see how the color and patterns of the two objects interact to create a new color/pattern scheme.

12. Change the ellipse to a different shape. After selecting the ellipse, choose **Reshape** from the **Edit** menu. Reshape handles appear on the ellipse. Use the reshape handles by clicking and dragging the mouse to reshape the object.

13. Let's make the ellipse fall behind the rectangle on the display. With the ellipse selected, choose the **Arrange** menu. From that menu, choose **Move to Back**.

14. To be sure the ellipse is placed directly in the center of the rectangle, we can align the two objects. Select the ellipse and then select the rectangle while holding the ⌜Shift⌟ key. This allows you to select both objects. With both the ellipse and rectangle selected, choose the **Arrange** menu and select **Align...**. In the **Align** dialog box, select **Align To Each Other**. Click, in order: **Vertical Center**, ⌜ **Apply** ⌟, **Horizontal Center**, and finally ⌜ **Align** ⌟. This perfectly centers the ellipse on the rectangle.

    The two objects you have created will remain "static" and therefore do not need any of their attributes edited. Now let's create a dynamic object.

15. From the tool palette, click on the regular polygon tool with the right mouse button and select the octagon shape (8 sides). Create an octagon by clicking on the octagon shape on the tool palette with the left mouse button. Your cursor will change to a cross-hair as it is moved into the work area. Click and drag the left mouse button to the desired size and release the button.

16. With the octagon selected, press the right mouse button and select **Set Object Attributes...** from the **Display Popup Menu**.

17. Within the **Object Is** frame on the **Set Regular Polygon Attributes** dialog box, select the **Dynamic** radio button.

18. In the **Data Attributes** frame, click on ⌜MSID:⌟ search for the MSID: **D71X4001E**. Highlight the MSID in the list and click on ⌜ **Select** ⌟.

19. In the **Line Color Representation** frame, select the **State Violation** radio button, and define the expected state color.

20. In the **Fill Color Representation** frame, select the **State Code** radio button, and define the colors for the object's various states (use a different color for each state code). Enter the MSID in the **Recall Text** frame, and click on ⌜ **Set** ⌟.

21. Open the **Define** menu and select **Fit Display to Objects**. Go to the **File** menu and select **Save**. Save your display using your first name.

22. To check the MSID on your display against the available databases, click on the **Validate** menu and select the **Validate...** option. Select the desired databases from the **Validate** dialog box and click [**Validate**] .

23. Now start Display Operation by clicking on the Launchpad's **Operation** menu. Select **Display Operation**.

24. When the **Display Operation** main window appears, select the **File** menu. Then choose **Open...**. In the dialog box, you will see the name of the display you just created. Click on it and then click [**Open**] . Your display should begin to operate with the octagon flashing periodically.

Review Questions

Instructions

Indicate an answer for each question below. The correct answers are given immediately following the questions.

1. Name two ways that you can change the size of your display.

    1). _____

    2). _____

2. True or False? If you change the text attributes available on the main window of **Display Generation**, it affects all objects that have been drawn.

3. What can a primitive object be used for? Dynamic primitive objects?

4. What are the functions of each mouse button?

    Left _____

    Middle _____

    Right _____

5. Name the three ways you can set the attributes of an object.

    1). _____

    2). _____

    3). _____

Review Answers

1. Use the display resize handle (small black box in the corner of the display).

   Use the **<u>D</u>efine Display Settings...** option under the **<u>D</u>efine** menu.

2. False - it only affects the objects that you have selected.

3. Typing text, creating geometric shapes, or assigning an image to an object

   Dynamic primitive objects have MSIDs assigned to them, and they change based on incoming data.

4. Left selects objects

   Middle moves objects

   Right invokes pop-up menus

5. Double-click on the object whose attributes you wish to edit.

   Select the object you wish to edit using the arrow selection tool. Then, while you cursor is inside the work area of the main window, click your right mouse button to initiate a popup menu. From this menu, select **Set Object <u>A</u>ttributes...**.

   Select the object whose attributes need editing. Select the **<u>D</u>efine** menu, and then choose **Set Object <u>A</u>ttributes...**.

Module 3
An Overview of Output Objects

Output objects serve the singular purpose of displaying space vehicle telemetry data in a graphically represented form. These objects include plots, bar charts, pie charts, toggle buttons, radio buttons, output sliders, and radial meters. An additional object, the MSID Text Tool, is a custom-designed object used for the straightforward text display of parameter values when graphical representation is not required.

Each of the output objects has its own set of attributes that can be defined in the same way that primitive object attributes are assigned. This module will introduce each of the output objects and provides exercises to guide you through creating a display which uses these objects.

The **Display Generation** tool palette includes eight output object tools (see Figure 3-1, Output Object Drawing Tools) which are indicated in the diagram below:
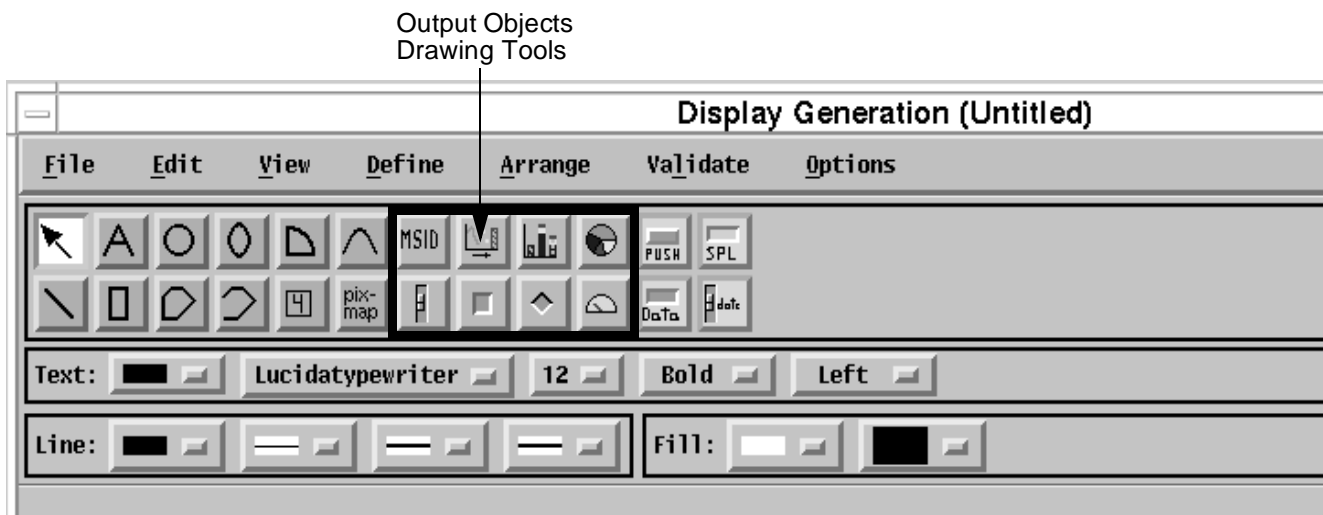

Figure 3-1, Output Object Drawing Tools

These output object tools appear on pink buttons. To use one of the tools, simply click on it and your cursor can be used in the main drawing area to create the selected object. To create multiple instances of an object without having to re-click the tool button, double-click the tool button to enter "multiple drawing" mode.

The following sections illustrate how to create each of the output objects.

The **MSID Text Tool** allows you to create MSID fields for viewing telemetry data. An MSID is a unique parameter identifier assigned to each telemetered parameter. Its unprocessed, converted, or calibrated value can be shown using this object. This object consists of a label and a data field.

To Create MSID Text Objects:

This tool requires one click.

Click on the **MSID Text Tool**. When you move the cursor into the work area, the cursor will change to a ✛. Click where you want the top, left corner of the object to be created.

The **Plot Tool** allows you to create either a time plot or an XY plot. A time plot has up to four Y-axis parameters plotted against a single X-axis time parameter. An XY plot contains one X-axis parameter and four Y-axis parameters. Plots can be configured to have the grid showing, a legend showing as well as labels for the X and Y axes. Each Y-axis parameter can have a color assigned for the **Nominal/Expected State:**. The default plot type created is a **Time**, **Line** plot.

To Create a Plot:

This tool requires a click, drag, and release.

1. Click on the **Plot Tool**. When you move the cursor into the work area, the cursor will change to a ✛.

2. Move the cursor into the drawing area, press and hold down the left mouse button. The point at which you press the left mouse button defines a corner of the plot.

3. Move the mouse in any direction to define the size of the plot. The point at which you release the mouse button will define the size of the plot.

The **Bar Chart Tool** allows you to create a bar chart using a maximum of five parameters. Each parameter can have a color assigned for the **Nominal/Expected State:**. The chart can be configured to have the grid and a legend showing, as well as a label for each bar and the X and Y axis.

To Create a Bar Chart:

This tool requires a click, drag and release.

1. Click on the **Bar Chart Tool**. When you move the cursor into the work area, you should see ✛.

2. Move the cursor into the drawing area, press and hold down the left mouse button. The point at which you press the left mouse button defines a corner of the bar chart.

3. Move the mouse in any direction to define the size of the bar chart. The point at which you release the mouse button will define the size of the bar chart.

The **Pie Chart Tool** allows you to create a pie chart using up to ten parameters. Each parameter is represented by a pie slice and can have a color assigned for the expected state or nominal value. The chart can be configured to have the grid and a legend showing, as well as labels for each slice.

To Create a Pie Chart:

This tool requires a click, drag, and release.

1. Click on the **Pie Chart Tool**. When you move the cursor into the work area, the cursor changes to a ✛.

2. Move the cursor into the drawing area, press and hold down the left mouse button. The point at which you press the left mouse button defines a corner of the pie chart.

3. Move the mouse in any direction to define the size of the pie chart. The point at which you release the mouse button will define the size of the pie chart.

The **Output Slider Tool** allows you to create a sliding scale (a scroll bar without arrows). A telemetry MSID may be assigned to the scale and the slider will move up and down based on the current value of the telemetry parameter. You can configure the slider so that it is oriented horizontally or vertically.

To Create an Output Slider:

This tool requires a click, drag, and release.

1. Click on the **Output Slider Tool**. When you move the cursor into the work area, the cursor will change to a ✛.

2. Move the cursor into the drawing area, press and hold down the left mouse button. The point at which you press the left mouse button defines a corner of the output slider.

3. Move the mouse in any direction to define the size of the slider. The point at which you release the mouse button will define the size of the slider.

The **Toggle Button Tool** allows you to create a button that graphically represents the state of bit discrete MSIDs.

To Create a Toggle Button:

1. Click on the **Toggle Button Tool**. When you move the cursor into the work area, the cursor will change to a ✛.

2. Move the cursor into the drawing area, press and hold down the left mouse button. The point at which you press the left mouse button defines a corner of the toggle button.

3. Move the mouse in any direction to define the size of the toggle button. The point at which you release the mouse button will define the size of the toggle button.

The **Radio Box Tool** allows you to create a radio box that provides a graphic representation for the state of group discrete parameters.

To Create a Radio Box:

This tool requires a click, drag and release.

1. Click on the **Radio Box Tool**. When you move the cursor into the work area, the cursor will change to a ⊹.

2. Move the cursor into the drawing area, press and hold down the left mouse button. The point at which you press the left mouse button defines a corner of the radio box.

3. Move the mouse in any direction to define the size of the radio box. The point at which you release the mouse button will define the size of the radio box.

The **Radial Meter Tool** is used to build a radial meter, an object resembling a speedometer, with a telemetry MSID assigned to it. The gauge will move from one side to the other based on the current value of the telemetry parameter assigned to the meter. The **Radial Meter Tool** allows you to create a 180$^{\text{o}}$ or 360$^{\text{o}}$ radial meter with the default being 180$^{\text{o}}$. To select the 360$^{\text{o}}$ meter, you must change the object attributes associated with the radial meter.

To Create a Radial Meter:

1. Click on the **Radial Meter Tool**. When you move the cursor into the work area, you should see ⊹.

2. Move the cursor into the drawing area and press and hold down the left mouse button. The point at which you press the left mouse button defines a corner of the radial meter.

3. Move the mouse in any direction to define the size of the meter. The point at which you release the mouse button will define the size of the radial meter.

Now that you have the information needed to create these output objects, let's enhance the display we created in the previous module to include some of these objects. Refer to the sections earlier in this module for explicit directions for each object.

Exercises

Instructions	The following "Try It" allows you to build a display using output objects. Carefully read and complete each step.

Try It...

1. Start the Display Generation application. From the Launchpad's **Generation** menu, select **Display Generation**.

2. From the **Display Generation** main window, select **File** and click **Open...**. In the dialog box, select the display you created in the previous module and click ⬚ **Open** . Your display will fill the work area.

3. Create an MSID text field on the display by clicking the **MSID Test Tool** on the tool palette. The cursor will change to a cross-hair. Click within the work area to place the measurement.

4. With the MSID text field item selected, click the right mouse button and select **Set Object Attributes...** from the **Display Popup Menu** to invoke the **Set MSID Text Attributes** dialog box.

5. Within the **Object Attributes** frame, insert the measurement's technical name **Primary Freon Pump Temperature (OI129)** in the **Label:** text field. Select your desired font, size, style, and nominal text color.

6. Within the **Data Attributes** frame, click on ⬚ **MSID:** voke the **Select MSID** dialog box.

7. Perform a search by selecting **Technical Name:** from the **MSID:** option menu button in the **Search Criteria** frame. Enter ***Primary*** in the input data field. Select ⬚ **Search** . The **MSID List** should display all MSIDs within the database that contain the word **Primary** in their technical name.

8. Select the MSID **C71T2002A Primary Freon Pump Temperature (OI129)**. Click on ⬚ **Select** . The MSID will be entered into the ⬚ **MSID:** field on the **Set MSID Text Attributes** dialog box.

9. Set **Data Processing** to **Calibrated**.

10. In the **Data Representation** portion of the **Data Attributes** frame, you may select whether you want to use the database default data representation or define your own format from those available for that data type. Choose the default data representation for this exercise.

11. In the **Recall Text** frame, type the MSID and any other comment text you'd like to display in **Display Operation**. Click on ⬚ **Set** .

12. Create a time plot by clicking on the **Plot Tool** on the tool palette. The cursor will change to a cross-hair. Click within the work area and drag the object to the desired size. Release the mouse button.

13. With the time plot selected, click the right mouse and select **Set Object Attributes...** from the **Display Popup Menu**. The **Set Plot Attributes** dialog box is invoked.

14. In the **Plot Type** frame, select the **Line** radio button next to **Time:**.

15. In the **Data Attributes** frame, provide an **X Axis Label:** and a **Y Axis Label:** in the input text fields. Since this is a time plot, use **GMT** as your X-axis label. Use **Temperature** for the Y-axis label.

16. Within the **Data Attributes** frame, click on [**MSID:**] e the **Select MSID** dialog box. Using the scrollbar, search for the MSID **E71T2002A**. Select the MSID by clicking on it and clicking [**Select**]. In the **Recall Text** frame of the **Set Plot Attributes** dialog box, type the MSIDs and any other comment text you'd like to display in **Display Operation**. Click on [**Set**].

17. Now create a toggle button on the display by clicking on the **Toggle Button Tool** on the tool palette. The cursor will change to a cross-hair. Click within the work area and drag the object to the desired size. Release the mouse button.

18. With the toggle button selected, click the right mouse and select **Set Object Attributes...** from the **Display Popup Menu**. The **Set Togglebutton Attributes** dialog box is invoked.

19. In the **Object Attributes** frame of the dialog box, supply the **Label:** name **ON/OFF Status**.

20. Within the **Data Attributes** frame, click on [**Bit Discrete MSID:**] the **Select MSID** dialog box. Select the bit discrete MSID **E71X2003E** by clicking on it and pressing [**Select**]. In the **Recall Text** frame of the **Set Togglebutton Attributes** dialog box, type the MSID and any other comment text you'd like to display in **Display Operation**. Click on [**Set**].

21. Create an output slider by clicking on the **Output Slider Tool** in the tool palette. The cursor will change to a cross-hair. Click within the work area and drag the object to the desired size. Release the mouse button.

22. With the output slider selected, click the right mouse and select **Set Object Attributes...** from the **Display Popup Menu**. The **Set Output Slider Attributes** dialog box is invoked.

23. In the **Object Attributes** frame of the dialog box, supply **Frame Counter** as the **Label:**. For the **Maximum Value Location:**, select the **Bottom/Right** radio button. For the **Orientation:**, select the vertical bar (the right-hand selection).

24. Within the **Data Attributes** frame, click on ⎡ **MSID:** ⎤ e the **Select MSID** dialog box. Select the MSID **"C71Q5003A"** by clicking on it and pressing ⎡ **Select** ⎤. In the **Recall Text** frame of the **Set Output Slider Attributes** dialog box, type the MSID and any other comment text you'd like to display in **Display Operation**.

25. In the **Minimum Value:** and **Maximum Value:** fields, use the default values. Click on ⎡ **Set** ⎤.

26. Click on the **Define** menu and select **Fit Display to Objects**. Go to the **File** menu and select **Save**. Save your display using your first name.

27. Now start Display Operation by clicking on the Launchpad's **Operation** menu. Select **Display Operation**.

28. When the main window appears, select the **File** menu. Then choose **Open...**. In the dialog box, you will see the name of the display you just created. Click on it and then click ⎡ **Open** ⎤. Your display should begin to operate.

Review
Questions

Indicate an answer for each question below. The correct answers are given immediately following the questions.

1. What are output objects?

2. Name at least four different types of output objects.

    1). _____

    2). _____

    3). _____

    4). _____

3. What is the custom-designed object used for the straightforward text display of parameter values when graphical representation is not required?

4. What is the maximum number of parameters you can use on a bar chart?

5. What is the maximum number of parameters you can use on a pie chart?

Review Answers

1. Objects with telemetry parameter values being represented by realtime data fields.

2. Plots (Time or XY)
   Bar charts
   Pie charts
   Radial meters
   Output sliders
   Toggle buttons
   Radio boxes

3. MSID text tool

4. Five

5. Ten

Module 4
Taking Control with Input Objects

Displays can be made interactive in that they can be used to start computation, scripts, and other displays. They can also initiate the uplinking of a command. Any task that can be accomplished using a scratchpad line directive can be achieved through a display. These tools allow you to create objects such as pushbuttons, scratchpad line (SPL) fields, input data fields, and input sliders. Within the Display Operation application, the pushbutton or SPL field allows you to initiate an action (SPL directive). SPL directives provide the capability to start a script, start a computation, start a display, uplink a command, etc. Pushbuttons and SPL fields can be used for any SPL directive. Input sliders and input data fields can only be used for updating computation constants and external pseudo-MSIDs.

Display Generation provides a number of input objects that allow the user to interact with the display. Each of the input objects has its own set of attributes that can be defined in the same way that primitive and output object attributes are assigned. This module will introduce each of the input objects and provides an exercise to guide you through creating a display which uses these objects.

The Display Generation tool palette includes four input object tools (see Figure 4-1, Input Object Drawing Tools) which are indicated in the diagram below:
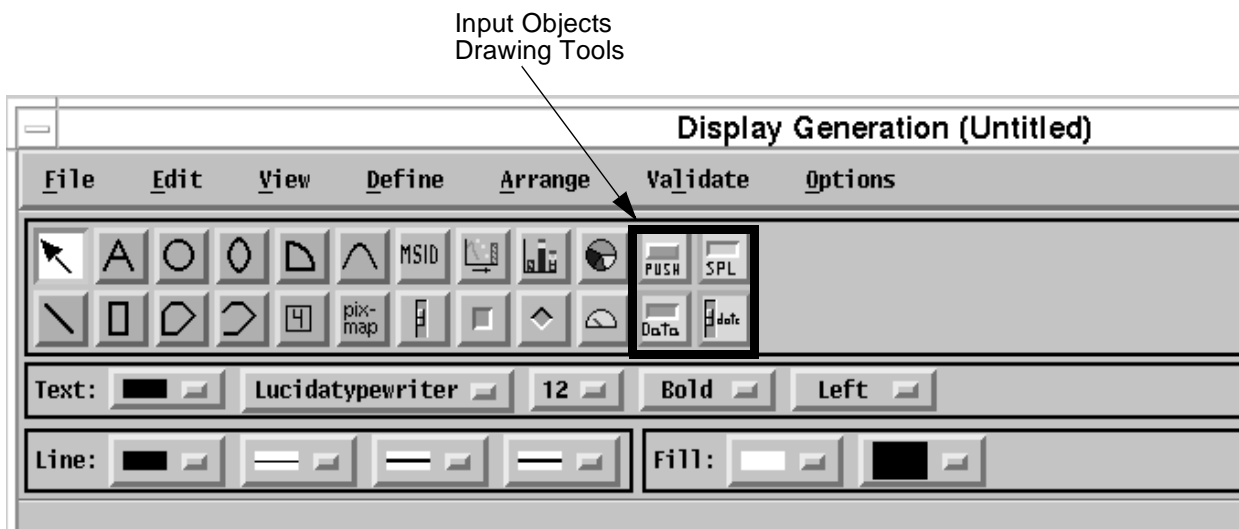
Figure 4-1, Input Object Drawing Tools

These input object tools appear on yellow buttons. To use one of the tools, simply click on it and your cursor can be used in the main drawing area to create the selected object. To create multiple instances of an object without having to re-click the tool button, double-click the tool button to enter "multiple drawing" mode.

The following sections illustrate how to create each of the input objects.

The **Pushbutton Tool** allows you to create a button with a text label or pixmap on it and an SPL directive associated with it. A pushbutton can be created to start a computation, start a script, start a display, uplink a command, etc.

To Create a Pushbutton:

This tool requires a click, drag, and release.

1. Click on the **Pushbutton Tool**. When you move the cursor into the work area, the cursor will change to a ＋

2. Move the cursor into the drawing area, press and hold down the left mouse button. The point at which you press the left mouse button defines a corner of the pushbutton.

3. Move the mouse in any direction to define the size of the pushbutton. The point at which you release the mouse button will define the size of the pushbutton.

The **Scratchpad Line Field Tool** allows you to create a labeled field and assign a SPL directive to start a computation, start a display, start a script, uplink a command, etc. This field is similar to a pushbutton, except that either a complete SPL directive, partial SPL directive or no SPL directive can be assigned to the SPL field.

To Create an SPL Field:

This tool requires a click, drag, and release.

1. Click on the **Scratchpad Line Field Tool**. When you move the cursor into the work area, the cursor will change to a ╫

2. Move the cursor into the drawing area, press and hold down the left mouse button. The point at which you press the left mouse button defines a corner of the SPL field.

3. Move the mouse in any direction to define the size of the SPL field. The point at which you release the mouse button will define the size of the field.

The **Input Data Field Tool** allows you to create an object with a label and a text entry field. You can assign an **External Pseudo MSID:** or **Computation Constant:** to this field. The value you assign in Display Operation to the external pseudo MSID or constant, will then be used in its associated computation.

To Create an Input Data Field:

This field requires a click, drag, and release.

1. Click on the **Input Data Field Tool**. When you move the cursor into the work area, the cursor will change to a ✛.

2. Move the cursor into the drawing area, press and hold down the left mouse button. The point at which you press the left mouse button defines a corner of the input data field.

3. Move the mouse in any direction to define the size of the input data field. The point at which you release the mouse button will define the size of the input data field.

 The **Input Slider Tool** allows you to create an input slider that has a computation constant or pseudo-MSID assigned to it. You can assign an **External Pseudo MSID:** or **Computation Constant:** to this field. The value you assign in Display Operation, will then be used in its associated computation.

To Create an Input Slider:

This tool requires a click, drag, and release.

1. Click on the **Input Slider Tool**. When you move the cursor into the work area, the cursor will change to a ✛.

2. Move the cursor into the drawing area, press and hold down the left mouse button. The point at which you press the left mouse button defines a corner of the slider.

3. Move the mouse in any direction to define the size of the input slider. The point at which you release the mouse button will define the size of the slider.

Now that you have the information needed to create these input objects, let's enhance the display we created in the previous module to include some of these objects. Refer to the sections earlier in this module for explicit directions for each object.

Exercises

Instructions	The following "Try It" allows you to build a display using input objects. Carefully read and complete each step.
Try It...	1. Start the Display Generation application. From the Launchpad's **Generation** menu, select **Display Generation**.
	2. From Display Generation, select **File** and click **Open...**. In the dialog box, select the display you created in the previous module and click [Open]. Your display will fill the work area.

3. Before adding any new objects, let's set up a working grid to which objects will snap, thereby making it easier to line up objects. From the **View** menu, select **Setup Grid...**. Click the **Snap to Grid** toggle button. You can also adjust the grid spacing to your preference. When you have finished setting up the grid, click `Set`.

4. Create a pushbutton by clicking on the **Pushbutton Tool** in the tool palette. The cursor will change to a cross-hair. Click within the work area and drag the object to the desired size. Release the mouse button.

5. With the pushbutton selected, click the right mouse and select **Set Object Attributes...** from the **Display Popup Menu**. The **Set Pushbutton Attributes** dialog box is invoked.

6. In the **Object Attributes** frame of the dialog box, select **Text String:** and enter the label **Start Display ISSOUTPUT** in the text field.

7. Within the **Button Action** frame, click the option menu button and select **Start Display**. In the associated text field to the right, enter the display name **ISSOUTPUT**. In the **Recall Text** frame of the **Set Pushbutton Attributes** dialog box, type the display name and any other comment text you'd like to display in **Display Operation**. Click on `Set`.

8. Create a scratchpad line field by clicking on the **SPL Field Tool** in the tool palette. The cursor will change to a cross-hair. Click within the work area and drag the object to the desired size. Release the mouse button.

9. With the SPL field selected, click the right mouse and select **Set Object Attributes...** from the **Display Popup Menu**. The **Set Scratchpad Line Field Attributes** dialog box is invoked.

10. In the **Object Attributes** frame of the dialog box, enter **Scratchpad Line Field** for the **Label:**.

11. Within the **Scratchpad Line Directive** frame, enter **Start Script** followed by the script name **SCRIPT_CLASS**. In the **Recall Text** frame of the **Set Scratchpad Line Field Attributes** dialog box, type the script name and any other comment text you'd like to display in **Display Operation**. Click `Set`.

12. Let's change the cyclic update rate of this display. Select the **Define** menu and then choose **Set Operation Defaults...**. Change the **Cyclic Update Increment (sec)** to **3**. Click `Set`.

13. Click on the **Define** menu and select **Fit Display to Objects**. Go to the **File** menu and select **Save**. Save your display using your first name.

14. This display uses external user-generated data elements (UDEs), including the display in step 7 and the computation step11. If these UDEs are not present on your workstation, the display will fail.To ensure that all UDEs are available, select the **Validate** menu. From this menu, choose **Check for UDEs**. If you are missing either of the required UDEs, you will need to retrieve them from the UDE Database. Ask your instructor for information on retrieving UDEs.

15. Now start Display Operation by clicking on the Launchpad's **Operation** menu. Select **Display Operation**.

16. When the main window appears, select the **File** menu. Then choose **Open...**. In the dialog box, you will see the name of the display you just created. Click on it and then click [**Open**]. Your display should begin to operate.

17. In the operating display, click on the pushbutton. A second instance of Display Operation is initialized and the designated display begins to operate.

18. Click on the SPL field and press [**Enter**]. The Script Operation application appears and the designated script is started.

Review Questions

Instructions   Indicate an answer for each question below. The correct answers are given
immediately following the questions.

1. What are input objects?

2. Name the four types of input objects.

    1). _____

    2). _____

    3). _____

    4). _____

3. Name three actions you can "start" within display operations

    1). _____

    2). _____

    3). _____

4. Name the objects that allow you to update computation constants and
   external pseudos-MSIDs.

5. True or False? You do not have to assign an SPL directive to the SPL
   field.

6. Name the object that allows you to uplink or update a command.

Review Answers

1. Objects that allow you to initiate an action, such as starting another display, computation, or script.

2. Pushbuttons
    SPL fields
    Input data fields
    Input sliders

3. Start a display
    Start a computation
    Start a script

4. Input data field
    Input slider

5. True. You can either assign a complete SPL directive, partial SPL directive or no SPL directive to the SPL field.

6. Pushbutton

Module 5
Using Advanced Features

In this module you will learn to use some of the advanced features of the Display Generation application. These advanced features include generating a detailed report defining every aspect of your display, simultaneously generating multiple MSID fields, creating a custom pulldown menu, and defining a startup list within a display.

Generating a Display Report

Display Generation allows you to generate a detailed text report defining every aspect of your display. You can either print a copy of this report or export the report to a text file. Let's export a report on the current display:

1. If you don't have Display Generation up and running, start it from the Launchpad's **Generation** menu.

2. From Display Generation's **File** menu, select **Export Report...**.

3. In the **Export to Text File:** input text field, type the name of the text file you wish to generate as a report. Use the filename "display_*xxx*" where *xxx* are your initials.

4. Click Export .

To view the file, select the **View Report** menu item from the **Options** menu.

To include the file in a report within a word processor type report, start Framemaker by selecting **Framemaker** from the **Utilities** menu on the Launchpad.

1. Click the **Open** button.

2. Find the **doc** directory and double-click.

3. Locate the file display_*xxx* where *xxx* are your initials. Double-click on the file or select the file and click Open .

Creating a Custom Pulldown Menu

The **Create Pulldown <u>Menu</u>...** menu item available under the **<u>Define</u>** menu allows you to define a customized menu with user-defined menu items, cascade menus, and separators. The items on the menu and subsequent cascade menus, execute SPL directives (see Figure 5-2, Sample Pulldown menu) . These directives may include starting scripts, starting computations, starting displays, initiating commands, etc.

Figure 5-2, Sample Pulldown menu

1. Click on **Create Pulldown <u>Menu</u>...** from the **<u>Define</u>** menu (see Figure 5-3, Create Pulldown menu).

2. Click in the field next to the **Pulldown Menu Label:** and type the desired name for your pulldown menu. This label will be displayed on the **Display Operation** menu bar.

3. Click on the ▷ to create new menu items.

4. Under the **Menu Items** column, provide a title for the pulldown which will describe its associated action.

5. Under the **Item Type** column, click on the option menu button and select either an SPL directive, a separator (-), or a cascade menu. If the selected item is a separator, any text provided under **Menu Items** disappears and is replaced by a bar.

Figure 5-3, Create Pulldown menu

6. If the selected item is **S Pad Line:**, supply the associated SPL directive in the field provided.

7. If the selected **Item Type** is a cascade menu, click on <kbd>Define Sub-Menu...</kbd> that appears to define its menu content (see Figure 5-4, Define Sub-Menu dialog box). A cascade menu cannot contain cascade type sub-menus, so at this point, only SPL directives and separators can be chosen.
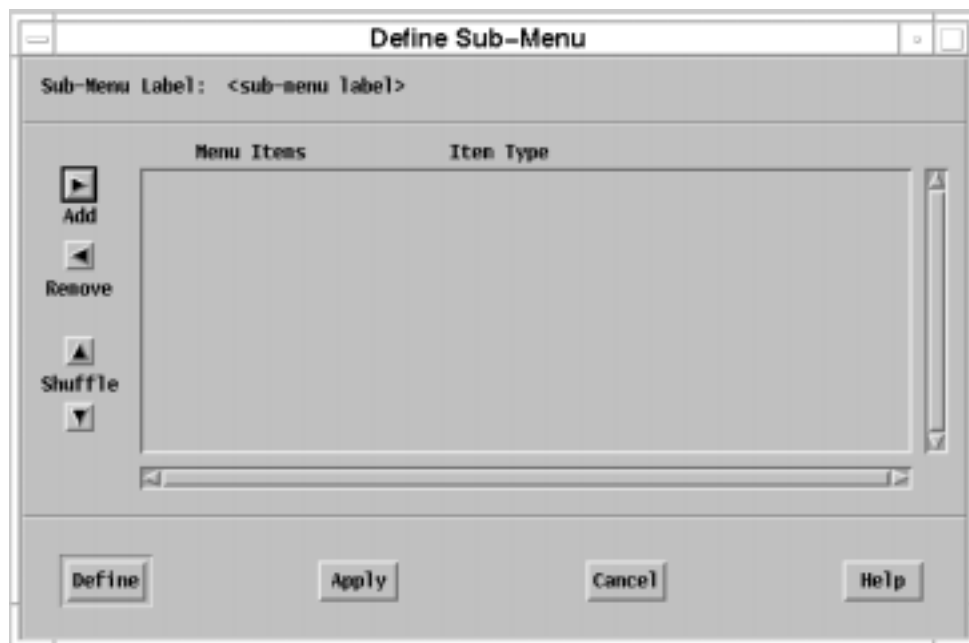
Figure 5-4, Define Sub-Menu dialog box

A. Click on ▷ to define the sub-menu item.

B. Under the **Menu Items** column, provide a title for the SPL which will describe its associated action.

C. Click on the option menu button under **Item Type** and select either a **Separator** or a **S Pad Line:**. If the selected item is a separator, any text provided under **Menu Items** disappears and is replaced by a bar.

D. If **S Pad Line:** button is selected, click in the field next to the **S Pad Line:** option menu button and type the SPL directive.

E. Repeat steps A - D until all sub-menu items are defined.

F. Click [**Define**].

Help: For a complete list of SPL directives, see Using the HOSC Scratchpad Line Software (HOSC-EHS-128).

8. Repeat steps 3 - 7 for each menu item you want to add.

9. Click [**Create**] when all menu items are defined.

Note: The maximum number of menu items you can create is 45. The maximum number of sub-menu items is also 45.

Note: The mnemonic for each menu and sub-menu item is automatically selected.

Tip: If you want to change the name of the cascade menu, you must change it from the **Create Pulldown Menu** dialog box.

Shuffle Items or Remove Them From a User-Defined Pulldown Menu:

1. Click the togglebutton located left of the menu item that you want to remove or shuffle.

2. Click on ◁ to delete the item.

3. Click on the **Shuffle** △   ▽ to rearrange the order of your menu items.

4. Click [**Create**] or [**Apply**].

Generating Multiple Text Fields

When you wish to monitor many parameters but do not wish to spend a great deal of time creating a display, you can have Display Generation create a display for you containing only MSID text objects.

Let's quickly create a display which monitors twenty MSIDs:

1. Make sure you have a new display available by selecting **New** from the **File** menu. If you have any unsaved changes from a previous display, you should save the currently open display at this time.

2. Enlarge your display so that it covers most of your screen. You will need plenty of room for Display Generation to generate your MSID text display.

3. From the **Options** menu, select **Generate MSIDText Objects...**.

4. In the dialog box, click `Select MSIDs`. In the **Select MSIDs** dialog box, click `Search`. When the list of available MSIDs is displayed, click your left mouse button on the first MSID and drag your mouse downward to select the first twenty MSIDs. Click `Select`.

5. In the **MSID Text Format** frame, set **Generate Label As:** to **Technical Name**. Set **Draw Outline Around:** to any desired format.

6. In the **Generate** frame of the **Generate MSIDText Objects** dialog box, select **Automatically, all at once**.

7. Click `Generate`.

   Once your MSIDs have been generated, make your display more attractive by aligning the MSID text objects by their centers.

8. Move your cursor to the upper left-hand corner of the display. Click and drag using the left mouse button to create a bounding box around the first column of MSIDs.

9. With the first column of MSID text objects selected, choose the **Arrange** menu and select **Align MSID Text...**.

10. Click **Center**, and then click `Align`.

    Repeat steps 8-9 for any additional columns of MSID text objects that appear on your display before proceeding to the next step.

11. Save your display and open it in Display Operation to watch it function.

Define Operation Startup List

You may want to have one controlling display that invokes other displays and computations. The **Define Operation** **S**tartup List... menu item allows you to select the computations and displays (elements) that you want to start when the display is invoked in Display Operation.

1. Click on **Define Operation S**tartup List... from the **D**efine menu.

2. Click on the type of files you want to see by selecting either the **Computations** or the **Displays** radiobutton. This will list all files of that type found on your workstation.

3. Select the element (display or computation) from the list by clicking on it or type the name of the element in the **Element:** field.

4. Click ▷ to add the element to the end of the **Startup Element** list. An option menu button will be provided under the **Terminate** column.

5. Click on the **Terminate** option menu button and select how you want each element to terminate (**Manually** or **With Display**). The default is to terminate **Manually**.

6. Click **Define**.

Shuffle Items or Remove Them From the Operation Startup List:

1. Click the togglebutton located left of the startup element that you want to remove or shuffle.

2. Click on ▷ to delete the item.

3. Click on **Shuffle** △ or ▽ to rearrange the order of your startup elements.

4. Click **Define**.

Review Questions

Indicate an answer for each question below. The correct answers are given immediately following the questions.

1. What is the purpose of Export Report?

2. What is the maximum number of menu items you can create on a pull-down menu?

3. What is an easy way to generate multiple MSID Text Fields?

4. What is the option that allows you to define what other UDEs you want initiated based on a display being opened?

Review Answers

1. To export the generated report to an ASCII text file that can then be imported into FrameMaker to be edited.

2. 45

3. With the **<u>G</u>enerate MSIDText Objects...** menu item:

    Select **<u>G</u>enerate MSID Text Objects...** (under the **<u>O</u>ptions** menu)
    Click **Select MSIDs**.
    Click **Search** t a list of MSIDs).
    Select the MSIDs you want on your display
    Select options on the **Generate MSID Text Objects** dialog box
    Select **Automatically, all at once**
    Click on **Generate** ll MSIDs on your display

4. **Define Operation <u>S</u>tartup List...** (under the **<u>D</u>efine** menu)

Module 6
Putting Your Skills to Use

In the previous modules, you were guided through the process of creating every drawing object that the Display Generation application has to offer. Now it is time to put your new skills to work to create fully functioning displays.

This module provides a number of graphic examples of displays you can create. These displays use external user-generated data elements such as the display you created in Module 3. Be sure to validate the display and check that the UDEs are available on your workstation. If not, you will need to retrieve the necessary UDEs from the UDE Database.

Once you have built the displays, start the Display Operation application available from the **Operation** menu on the **Launchpad**. Click on the **File** menu and select **Open**. Open each display and verify that it operates correctly. If it does not, fix it and save it within Display Generation and then re-open it within Display Operation.

Exercise 1:
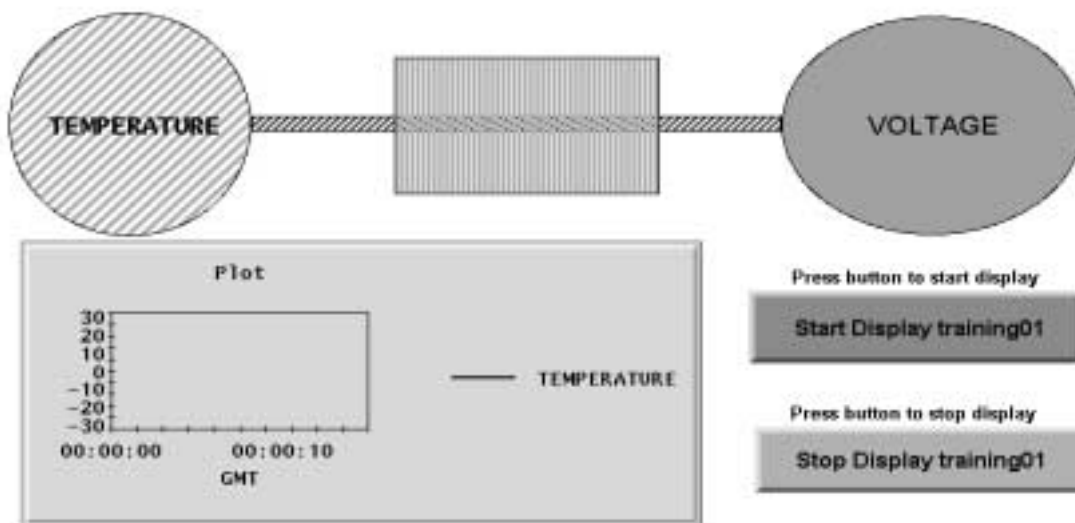
Use the MSIDs listed below for each object:

Circle: choose **Dynamic**, assign MSID **D71T2002A**, label as **Freon Temperature**.

Rectangle: make this a **Static** object, and select a color.

Ellipse: choose **Dynamic**, assign MSID **D71X4001E**, label as **Freon Status**.

MSID Text Field: label as **Freon Temperature**, assign MSID **D71T2002A**, choose **Calibrated** data processing, and define as **Decimal/Real**.

MSID Text Field: label as **Freon Status**, assign MSID **D71X4001E**, choose **Calibrated** data processing, and use the default data representation.

Start Pushbutton: assign label and directive **Start Display ISSPRIMOBJ**.

Stop Pushbutton: assign label and directive **Stop Display ISSPRIMOBJ**.

Exercise 2:
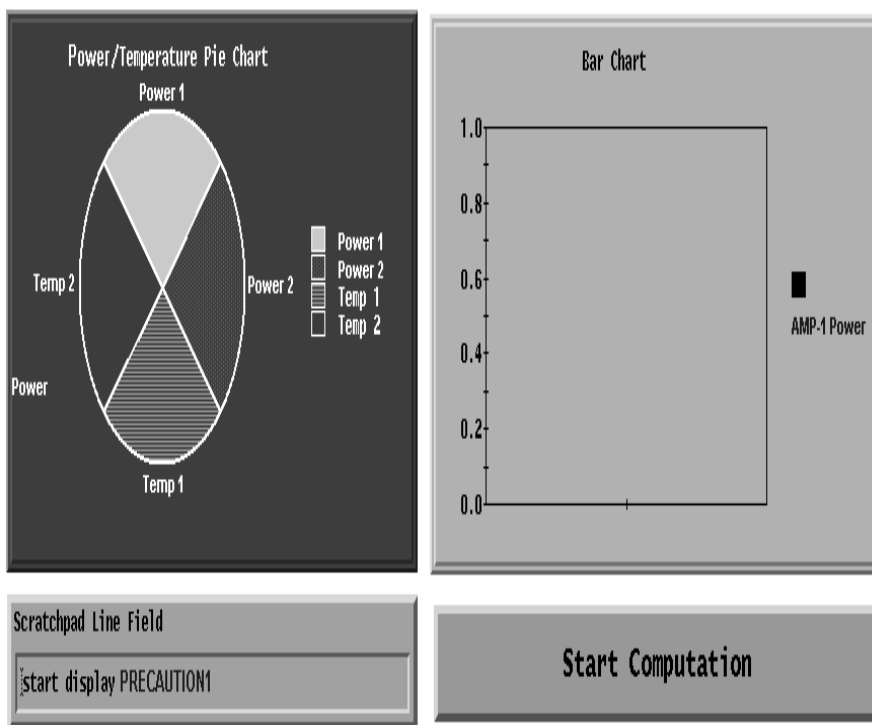
Use the MSIDs listed below for each object:

Pie Chart: label as **Pie Chart**, assign MSIDs and Slice labels as follows:

Slice 1 - label as **Freon Temp 1**, assign MSID **D71T2002A**.

Slice 2 - label as **Freon Temp 2**, assign MSID **E71T2002A**.

Slice 3 - label as **Recirc Temp 1**, assign MSID **D71T2005A**.

Slice 4 - label as **Recirc Temp 2** - assign MSID **E71T2005A.**

Choose patterns and colors for each slice.

Bar Chart: assign MSID **C71Q5003A**, label as **Range Power/Noise Ratio**, assign minimum value as **0** and maximum value as **200**.

Line Plot: assign x-axis as **GMT**, assign y-axis MSID **D71T2005A**, label as **Temperature**, assign minimum value as **-1** and maximum value as **25**.

Exercise 3
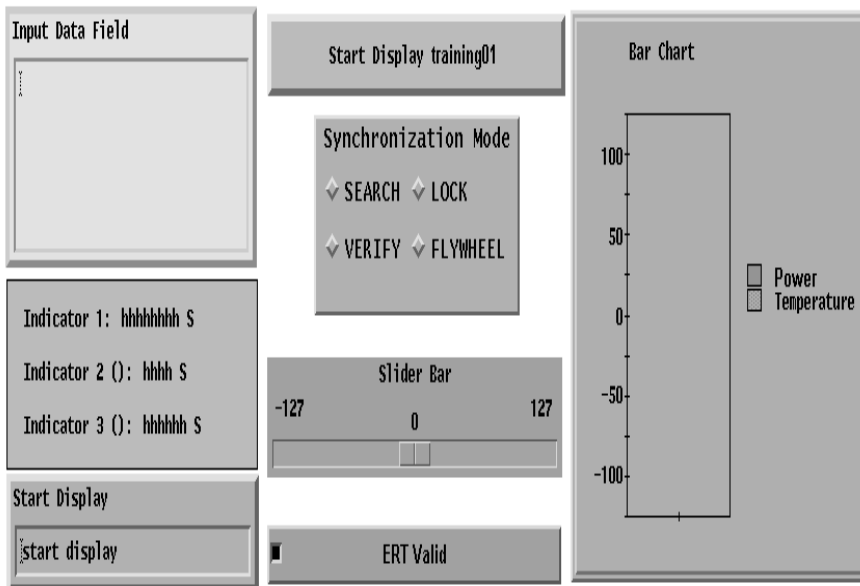
Use the MSIDs listed below for each object:

MSID Text Fields: assign labels and MSIDs as follows:

     Bit Discrete - assign MSID **E71X2003E**, select **Converted** data processing.

     Valve Status - assign MSID **D71X4001E**, select **Calibrated** data processing.

     Frame Counter - assign MSID **C71Q5003A**, select **Converted** data processing.

Togglebutton: assign MSID **E71X2003E** and label **ON/OFF Togglebutton**.

Radio Box: assign MSID **D71X4001E** and label **Valve Status**.

Output Slider: assign MSID **C71Q5003A**, label as **Frame Counter** with minimum value as **0** and maximum value as **200**.

Scratchpad Line Field: assign directive **Start Display ISSTEST**.

Scratchpad Line Field: assign directive **Stop Display ISSTEST**.

Start Computation Pushbutton: assign button label as **Start Computation** and enter **Start Comp ISSCOMP** for the button action scratchpad line directive.

Input Data Field: assign computation constant **$C0TEMP_REG** and **ISSCOMP**.

Exercise 4

Look within the File Manager application and see which displays are available. Add a custom pulldown menu to the display that you built in Exercise 3. The custom menu should allow you to start some of the displays that are available on your workstation. If no displays are available on your workstation, retrieve some using the Retrieve UDE application.

Exercise 5

Look within the File Manager application and see which displays are available. If no displays are available on your workstation, retrieve some using the Retrieve UDE application. Define an operation startup list for the display that you built in Exercise 2. The operation startup list should include three displays that are available on your workstation. Each one should be terminated manually.

Course Summary

Display Generation provides you with the capability to create, modify, and save customized displays which you build to view space vehicle telemetry data. The application provides drawing tools that allow you to create various objects on a display. These objects may include plots, data fields, pie charts, pushbuttons, etc. Objects may be built to display data, enter values, as well as send commands.

Once displays are built, Display Operation is the application you use to look at data on the displays. You can also uplink and update commands, start and stop displays, update variables, etc.

In this course, you learned how to use the drawing tools that are available within the Display Generation application and some of the advanced features such as custom pulldown menus and operation startup lists. You also learned how to quickly generate a display containing MSID text fields.

Appendix A
Questions and Answers

Use the following questions to review the areas covered in this workbook. The answers are also provided in this section.

Display Generation Questions

1. Name two ways to select the number of sides of a regular polygon.

2. What is the maximum number of sides for an irregular polygon?

3. How many Y-Axis parameters can be plotted?

4. How many slices are available for a pie chart?

5. How many bars are available for a bar chart?

Display Operation Questions

1. There is data that you want to see that is being processed in the dump mode. How would you change your data mode so that you can view this data?

2. When you open a display in the Display Operation application, you noticed some validation errors in Message Handler. How do you see what type of errors were encountered?

3. You want to examine a plot closer. How would you accomplish this?

4. What are status characters? Can they be disabled? If so, how?

5. What is recall text? How can you view it within the Display Operation application?

Display Generation Answers

1. There are three methods for selecting the number of sides of a regular polygon:

    A. When the tool palette is on the dialog box, click on the **Regular Polygon Tool** then click on △ or ▽ to select the desired number of sides.

    B. Click on △ or ▽ to select the desired number of sides and then click on the **Regular Polygon Tool**.

    C. Whether the tool palette is on the main window or on a dialog box, you can select the tool with the left mouse and then click with the right mouse button and select the number of sides.

2. 100.

3. 4.

4. 10.

5. 5.

Display Operation Answers

1. Select **Set** **D**ata Mode and Database Version... from the **Define** menu. Select the Dump radio button and click [Set].

2. Select **View Auto-Validation** **R**eport from the **Va**l**idate** menu.

3. Select **Z**oom Graph from the **Options** menu.
    Draw a bounding box around the area that you want to examine. (You must include one of the axis and start within the graph and draw outward).

4. Status characters provide you with insight as to the quality and validity of data being displayed. It can be disabled by selecting **Hide Status Characters** from the **Options** menu. The below table defines the current status characters:

Status Character	Definition
a	CDD Process Not Responding

Status Character	Definition
A	DP Process Not Responding
B	Common Configuration Error
c	Decom/Conv/Cal Status-Calibration Error
C	Decom/Conv/Cal Status-Conversion Error
d	Limits Not Defined in the Local Table
D	Decom/Conv/Cal Status-Decom Error
E	LES Status-Out of Expected State
f	Data Quality-DQ Failed (No data returned-old data is used)
F	Data Quality-DQ Failed with/Override (New data is used-bad data)
G	Packet Routing Table Configuration Error
H	LES Status-Warning High
K	Major Frame Parent Frame Error
L	LES Status-Warning low
M	Invalid Format for Data Type
N	Source Status-Loss of Signal (No data returned-old data used)
P	Telemetry Processing Discrepancies
Q	Major Frame Format ID Error
R	Source Status-Source Initialized/Unavailable
S	Data Condition-Old/Stale Data
T	Telemetry Database Discrepancies
U	Unrecognized/Invalid MSID
W	Memory Error
x	Data Quality-Data is Suspect (No data returned-old data is used)
Y	MSID Not Initialized For Decom
Z	Unrecognized Status from TNS_Initialize_Decom
v	LES Status-Caution Low
~	Data Quality-No Data (No data returned-old data used)
$	Invalid Status Received from EML
#	Data Format Field Overflow
^	LES Status-Caution High
?	Data Quality-DQ Suspect w/Override (New data is used-suspect data)

Status Character	Definition
'' (space)	Source Status-Acquisition of Signal (Parameter is okay-new data is returned)

5. Text entered in the Display Generation application for an object. This information may document useful notes concerning the MSID assigned to the object. The recall text is accessible within the Display Operation application by Select **Show Recall Text** from the **Options** menu. The **Show Recall Text (Pick Object)** dialog box is invoked. Point the mouse at the object on your display whose recall text you want to view, and press the left mouse button. The **Show Recall Text (Pick Object)** dialog box disappears, and the **Show Recall Text** dialog box is invoked. Click on ⬚ **Close** to close the **Show Recall Text** dialog box and return to the **Display Operation** main window. You can also initiate the show recall text function by clicking the right mouse button while the pointer is positioned over any object within a display. This will invoke the **Display Popup Menu**. If you select **Show Recall Text** from this menu the **Show Recall Text** dialog box for the object you were over will be displayed. When you use this method to view recall text, no **Show Recall Text (Pick Object)** dialog box is invoked.

Abbreviations and Acronym List

A/G   Air-to-Ground

A/M   Automatic/Manual

ADQ   Average Data Quality

AIS   Automated Information Security

ANSI   American National Standards Institute

AOS   Acquisition of Signal

API   Application Programming Interface

APID   Application Process Identifier

APT   Active Process Table

AR   Action Request

ASC   AXAF Science Center

ASCII   American Standard Code for Information Interchange

AST   Active Server Table

ATT   Attitude

AXAF   Advanced X-ray Astrophysics Facility

BFS   Backup Flight System

BG   Bit-contiguous Group

C   Counter-dependent

C   C Programming Language

CAP   Command Acceptance Pattern

CAR	Command Acceptance Response
CCBD	Configuration Control Board Directive
CCP	Central Command Processor
CCSDS	Consultative Committee for Space Data Systems
CDB	Command Database
CDD	Command Data Definition
CDQ	Current Data Quality
CLI	Command Line Interface
CM	Configuration Management
CMATS	Configuration Management Asset Tracking System
CMD	Command
CNT	Countdown Time
COTS	Commercial-Off-The-Shelf
CPU	Central Processing Unit
CRC	Circular Redundancy Check
CRR	Command Reaction Response
CSCI	Computer Software Configuration Item
CSM	Command System Management
CSS	Command System Services
CSS	Coarse Sun Sensor
CUI	Common User Interface
DADS	Data Acquisition and Distribution Services
DARL	Database Access Routine Library

DB	Database
DBA	Database Administrator
DBCG	Database Coordination Group
DBCR	Database Change Request
DBD	Database Developer
DCM	Document Configuration Management
DCR	Database Change Request
DCRG	Distributed Control Room Graphics
DDQ	Data Data Quality
DDS	Data Distribution System
DEMOS	Distributed Earth Model Orbiter Simulation
DG	Display Generation
DMC	Database Monitor and Control
DMC	Data Management Checklist
DO	Display Operation
DOSH	Database Operational Support History
DOT	Detailed Operations Timeling
DP	Distribute Packet
DPU	Data Processing Unit
DQ	Data Quality
DSN	Deep Space Network
EC	Experiment Computer
ECR	Engineering Change Request

EGSE	Experiment Ground Support Equipment
EHS	Enhanced HOSC System
ELF	Extremely Low Frequency
EM	Exception Monitor
EML	Extract MSID Library
ER	Engineering Request
ES	Expected State
FDDI	Fiber Distributed Data Interface
FEP	Front-End Processor
FEPSC	Front-End Processor Status and Control
FIFO	First-In-First-Out
FOT	Flight Operations Team
FPTNM	Foot-Pounds to Newton-Meters
FSS	Fine Sun Sensor
FSV	Flight System Verifier
FTAM	File Transfer Access and Management
FTP	File Transfer Protocol
GB	Gigabyte
GCID	Ground Correlation ID
GMT	Greenwich Mean Time
GPC	General Purpose Computer
GPS	Global Positioning System

GSE	Ground Support Equipment
GSFC	Goddard Space Flight Center
GUI	Graphical User Interface
H/W	Hardware
HAMASE	HOSC Automated Model and Screen Editor
HAPS	HOSC Advance Planning System
HASA	HOSC Administrative Software Account
HASS	HOSC Activity Scheduling System
HCR	HOSC Change Request
HDRR	High Data Rate Recorder
HDRS	High Data Rate System
HDRS DQ	High Data Rate System Data Quality
HLOG	HOSC Automated Logging System
HOSC	Huntsville Operations Support Center
HPR	HOSC Problem Report
HSD	HOSC Support Desk
HSR	HOSC Support Request
HTT	HOSC Training Team
HViDS	HOSC Video Distribution System
HVoDS	HOSC Voice Distribution System
I/O	Input/Output
ICD	Interface Control Document

ID   Identification

IDD   Interface Description Document

IDQ   Instantaneous Data Quality

IEEE   Institute of Electrical and Electronics Engineers

IP   Internet Protocol

ISS   INTERNATIONL Space Station

IST   Integrated Support Team

JSC   Johnson Space Center

kbps   kilobits per second

KMRTS   Kennedy Marshall Redundant Transmission System

KSC   Kennedy Space Center

LAN   Local Area Network

LES   Limit/Expected State Sensing

LOS   Loss of Signal

LOV   List of Values

LPS   Launch Processing System

LTG   Local Table Generation

LTO   Local Table Operation

M   Multi-syllable

MB   Megabyte

MCC	Mission Control Center
MCCU	Mission Control Center Upgrade
MDM	Multiplexer/Demultiplexer
MET	Mission Elapsed Time
MF	Maintenance Fixtures
MH	Message Handler
MOC	Mission Operations Computer
MOL	Mission Operations Laboratory
MOP	Mission, Operational Support Mode, and Project
MSFC	Marshall Space Flight Center
MSID	Measurement/Stimulus Identifier
MSL	Microgravity Science Laboratory
MTBF	Mean Time Between Failure
MUPS	Momentum Unloading Propulsion System
N	Normal
NASA	National Aeronautics and Space Administration
NASCOM	NASA Communications
NCC	Network Control Center
NDE	Non-operational Development Environment
NDL	NRT Data Log
NDL	Near Real-Time Data Logger
NEMS	NASA Equipment Management System
NG	Bit Non-contiguous Group

NGT	NASA Ground Terminal
NRT	Near Real-Time
NRZL	Non-Return-to-Zero-Level
NRZM	Non-Return-to-Zero-Mark
NSTS	National Space Transportation System
NTP	Network Time Protocol
OCC	Operations Control Center
OCDB	Operational Command Database
OCR	Operations Change Request
OD	Operational Downlink
ODE	Off-line Data Element
OFLS	Off-line System
OFLS	Off-line Software
OI	Operational Instrumentation
ONLS	On-line System
ONLS	On-line Software
OR	Observation Request
OS	Operating System
OSF	Open Software Foundation
OTE	Operational Test Equipment
PAP	Payload Activity Plan
PAYCOM	Payload Commander

PB	Playback
PC	Polynomial Coefficient
PC	Personal Computer
PCAD	Pointing Control and Aspect Determination
PCDB	Project Command Database
PCM	PIMS Configuration Management
PDI	Payload Data Interleaver
PDRF	Playback Data Request Form
PDSS	Payload Data System Services
PFS	Primary Flight System
PI	Principal Investigator
PID	Process Identifier
PIMS	Payload Information Management System
PMAT	Platform Mode Attributes Table
POCC	Payload Operations Control Center
POD	Payload Operations Director
POIC	Payload Operations Integration Center
PP	Point Pair
PPS	Payload Planning System
PRT	Packet Routing Table
psi	pounds per square inch
PTC	Payload Training Complex
PTDB	Project Telelemetry Database

R	Range-dependent
RAM	Random Access Memory
RCS	Reaction Control System
RDBMS	Relational Database Management System
RDRP	Raw Data Record Playback
RID	Review Item Discrepancy
RPM	Rounds per Minute
RR	Replanning Request
RSS	Resident Size
RT	Real-time
RTAS	Radians to Arcsecs
RTD	Radians to Degrees
RTDS	Real-time Data System
RTS	Requirements Tracking System
RUM	Remote User Machine
RW	Reaction Wheel

S	Super
S&E	Science and Engineering
SC	State Code
SC	Subsystem Computer
SCM	Status and Configuration Manager
SCR	Strip Chart Recorder
SDT	Shuttle Data Tape

SGI   Silicon Graphics Indy™

SGI   Silicon Graphics Incorporated

SL   Spacelab

SM   System Monitor

SMAC   System Monitor and Control

SMCM   System Monitor and Control Configuration Manager

SN   Space Network

SNMP   Simple Network Management Protocol

SOA   Science Operations Area

SPL   Scratchpad Line

SQL   Structured Query Language

SRD   Serial Receive Device

SRS   Software Requirements Specification

SS   System Services

SSCC   Space Station Control Center

SSME   Space Shuttle Main Engine

SSUP   System Services User Profile

STS   Space Transportation System

T   Typical

TBD   To Be Determined

TBS   To Be Supplied

TCP/IP   Transmission Control Protocol/Internet Protocol

TDB   Telemetry Database

TDM	Time Division Multiplexer
TDRSS	Tracking and Data Relay Satellite System
TDS	Time Distribution System
TNS	Telemetry and Network Services
TNSDP	Telemetry and Network Services Distribute Packet
TTY	Teletype
UDE	User-generated Data Element
UFT	Unrestricted File Transfer
UGSE	User Ground Support Equipment
UI	User Interface
UPAR	User Profile Access Routine
UPD	User Performance Data
UTC	Universal Time Coordinated
VMS	Virtual Memory System
VV	Verification and Validation
WCP	Workstation Command Processor
WEX	Workstation Executive
WSGT	White Sands Ground Terminal

Glossary

Accelerator	A sequence of keys that provides immediate access to application functions. For example, Ctrl + N to invoke the **New** menu item.
Activation Type	Method used within local table application to activate a group. The defined methods are Time and Control.
Active Window	The workstation window that has input focus and in which keyboard entries impact and may appear. See "Input Focus."
Analog	A mechanism in which data is represented by continuously variable physical quantities.
Application Main Window	The primary window of a software application.
Application Process Identifier (APID)	The APID is an 11-bit field that is included in Consultative Committee for Space Data Systems (CCSDS) headers. It uniquely identifies the vehicle that created the source packet.
Application Title Bar	The bar at the top of a main window that consists of the window menu button, the title area, and the minimize and maximize buttons.
Apply Pushbutton	A pushbutton that implements any changes made within its dialog box, but leaves the dialog box on the screen so that additional changes can be made. See "OK Pushbutton."
Approve	In PIMS, this action is taken by a reviewer to signify approval that a document, change request, or data request be placed in the baselined state.
Archived Database	A telemetry database that no longer reflects the current real-time telemetry characteristic information. Only one archive database is available online at a time.
Attributes Defaults Bar	The area below the menu bar on the main window where application **Text:**, **Line:**, and **Fill:** default attributes are set.
Avtec™	A manufacturer of telemetry transmit and receive devices used in the Huntsville Operations Support Center (HOSC) Enhanced HOSC System (EHS) as the primary telemetry processing hardware devices.
Baselined	In PIMS, the final state of the review cycle. When a document, change request or data request has been approved by all reviewers, the approver may place it in the baselined state.

Baselined Database	Database that reflects the current real-time telemetry or command characteristic information for a particular mission activity. Baselined databases have completed validation.
Block	NASA Communications (NASCOM) 4800-bit block format utilized for the transfer of data via the GSFC/MSFC Multiplexer/Demultiplexer (MDM) system.
Calibrated	Three types of calibration exist for telemetry samples: polynomial, point pair interpolation, and state code conversion. If calibration is requested, Telemetry and Network Services (TNS) automatically converts the unprocessed sample and then performs calibration on the sample for that Measurement/Stimulus Identifier (MSID) as defined in the local table.
Cancel Pushbutton	A pushbutton that allows a user to exit a dialog box without implementing any changes.
Cascade Menu	A sub-menu or menu-within-a-menu that appears when you highlight a menu function that has an arrow to the right of its name. Cascade menus are used to group similar functions together beneath the pulldown menu.
Caution	A standard icon used throughout the user guide set to represent destructive actions which could result in loss of data.
Caution Limits	A range defined by a high and low value for an analog MSID in the Telemetry Database (TDB) and Local Table. A color code (yellow) represents values within those ranges in the application.
CCSDS Packet	A source packet comprised of a 6-octet, CCSDS defined primary header followed by an optional secondary header and source data which together may not exceed 65535 octets.
Click	The action of pressing and releasing a mouse button. Typically, this is a left mouse button action.
Command System Manager	The position in charge of controlling the commanding system utilizing the Command System Management software. For AXAF projects, this is known as the PAYCOM position.
Commercial-Off-The-Shelf (COTS) Software	Software applications that have been purchased from a commercial software vendor as opposed to those that were developed internally.
Computation	A FORTRAN or C program used to further manipulate telemetry parameters. These programs are created by the Computation Generation application and are executed in Computation Operation.
Configuration Management (CM) Tools	Institutional applications that allow users to access and perform tasks, such as tracking requirements and equipment, scheduling resources, and logging into automated problem report systems.

Control Indicator	Used to indicate that the group will be activated for limit/ expected state (LES) sensing with either the control MSID or a control MSID plus delay time.
Control Panel	The area of a window where application pushbuttons and other graphical components are located.
Converted	The process of translating raw telemetry data into an American National Standards Institute (ANSI) standard data representation so that the sample can be properly interpreted by the machine which processes the data.
Counter-dependent	A parameter whose occurrence in telemetry is dependent on an incrementing or decrementing counter in the data.
Critical Command	A command whose initiation and execution could possibly cause damage to a payload or spacecraft and impair the mission.
Database Administrator	An individual who is primarily responsible for managing the RDBMS engine and administering database accounts. He/she also has the privilege to edit restricted database fields in any database, but is normally not recommended to edit data values that drive the telemetry and command processing for the EHS system.
Database Coordination Group	A working group which includes representatives from the appropriate project operations personnel, project source DB developers, MOL DB developers and the HOSC validation team. Review and approve/disapprove DBCRs, resolve conflicts and evaluate any DB-related issues.
Database Developer	An individual that has the privilege to edit restricted fields (e.g., decom, etc.) for both operational and non-operational databases that drive telemetry and command processing for the EHS system.
Dataset	A saved set of a command's modifiable fields used to update a command prior to being transmitted.
Delivered Database	A database must be delivered before it can become pre-released. A delivered database has not been validated for operational testing.
Delta Limit	Maximum acceptable difference between consecutive samples of a parameter.
Desktop	The computer monitor backdrop area on which all windows are opened. May also be referred to as workspace.
Development	In PIMS, the first state of the review cycle in which a document, change request, or data request is still being written or is being updated.

Direction Keys	A group of computer keyboard arrow keys which allow users to move up, down, left, and right within an application or menus.
Disapprove	In PIMS, the action taken by a reviewer to signify disapproval and recommendation against moving a document, change request or data request into the baselined state.
Discrete Values	Telemetry values that have states (e.g., on or off).
Double-click	The action of pressing and releasing a mouse button twice in rapid succession.
Drag	To press and hold down a mouse button while moving the mouse on the desktop (and the pointer on the screen). Typically, dragging is used while moving and resizing windows.
Drawing Tools Palette	A group of tool buttons that is used to create graphic objects in order to display telemetry data, initiate commands, and start scripts and computations. The palette is located on its own floating dialog box or the application window.
Dump	During periods when communications with the spacecraft are unavailable, data are recorded onboard and played back during the next period when communications resume. These data, as it is being recorded onboard, are encoded with an onboard embedded time and is referred to as dump data. When a near real-time (NRT) request is written specifying that dump data are desired, the onboard embedded time is used to fulfill the request.
Dynamic Objects	Graphical objects that represent updating telemetry data.
Ellipse	A geometric shape which can be created on a display (i.e., a plane of a cone, an oval shape, etc.).
Expected State	Text state code which indicates the nominal value of a parameter.
Expert Mouse Actions	Clicks or double-clicks of mouse buttons which are non-standard and which activate special functions.
File	The interpretation of a file is different based on the project that you are supporting. For AXAF, a file can be a command loard or a command group and for Space Station, a file is a command file.
Filter	The filter function is used within a dialog box to refine and define subsets of files you want to work with using a string search and wildcard. Characters can be used to implement the filter function.
Fonts	A style of printed text characters.
Graphical User Interface (GUI)	A way of interacting with computers using graphics-oriented software and hardware.

Grayed out	A menu selection item that has been made insensitive, which is visually shown by making the menu text gray rather than black. Items that are grayed out are not currently available.
Greenwich Mean Time (GMT)	The solar time for the meridian passing through Greenwich, England. It is used as a basis for calculating time throughout most of the world. Displayed within the HOSC, it follows the format ddd:hh:mm:ss.
Grid	A pattern of horizontal and vertical lines forming squares of uniform size on a display, used as a reference for locating points.
Group Parameter Composition	Parameter composition where the bits of a parameter are contiguous and a multiple occurrence of that parameter exists as a group of samples.
Groups	MSIDs which have been grouped together, primarily for use with the Exception Monitor (EM) application.
Hazardous Command	A command whose initiation and execution could pose a threat to human life or the entire mission.
Help	A standard icon used throughout the user guide set to indicate that a cross-reference is provided to assist in solving problems or to answer questions.
Huntsville Operations Support Center (HOSC)	A facility located at the Marshall Space Flight Center (MSFC) that provides scientists and engineers the tools necessary for monitoring, commanding, and controlling various elements of space vehicle, payload, and science experiments. Support consists of real-time operations planning and analysis, inter- and intra-center ground operations coordination, facility and data system resource planning and scheduling, data systems monitor and control operations, and data flow coordination.
I-beam Insertion Bar	A graphical image used to represent the insertion point of text in a text entry area which provides a visual cue that text entry is anticipated by the system.
Icon	A graphical representation of an object on the desktop. Objects can be minimized (iconified) to clear a cluttered workspace, and restored (opened), as needed.
Input Focus	A window or window element that is activated, and available for subsequent actions. Input focus is usually indicated by highlighting or changing the color of the activated element.
Input Slider	An input object that allows users to change values of pseudo parameters and computational constants assigned to objects. Pseudos can be used in other applications (i.e., scripts, computations, etc.).
Insensitive	An object or area of an application window that does not have input focus.

Integrated Support Team (IST)	Institutional groups at the HOSC responsible for configuring, monitoring, and resolving problems with computer systems and application software.
Launchpad	A floating menu bar that is used to initiate all HOSC software applications.
Legend	A table that labels parameters plotted on a chart or grid.
Limit Delta	Maximum acceptable difference between consecutive samples of a parameter.
Limit/Expected State Sensing (LES)	A configurable option in Display Operation that allows the user to select whether he/she wants to see limit violation status or not. The incoming data is compared against the Local Table limits.
Limits	Defined ranges for a measurement which are used to indicate off-nominal conditions: Caution High, Caution Low, Warning High, and Warning Low.
Line Plot	A plot that uses lines to represent the relationships among telemetry values.
Local Table	A subset of the TDB stored on a workstation or server used for telemetry processing.
Maximize Button	A control button that is located to the right of the application title bar. When pressed, this button enlarges the application window to its largest state.
Menu Bar	The area at the top of a window that contains the titles of pull-down menus.
Merge	The combining of data from different sources for a specific time slice. During merge, the best (cleanest) data from each source will be used to create a contiguous segment of data for the specified time slice.
Message Area	The part of the application window where system messages/responses are shown.
Message Dialog Box	An area that provides information, gives the current status of data, asks questions, issues warnings, or draws attention to errors.
Mini-Application	A secondary main window activated from within a main window application.
Minimize button	A control button located to the right of the application title bar. When pressed, it iconifies the window.
Mission, Operational Mode, and Project (MOP)	A MOP is what delineates one EHS activity from another. MOP information is available in the common configuration file on every node.

Mnemonic	An underlined character on a menu item, that allows users to initiate the item by typing letters on a keyboard. A user-friendly name used to reference a command residing in the command database.
Mode Independent	Mode Independent is used to describe any process that is not dependent on a data mode.
Modifiable Commands	Commands containing at least one data field which can be updated during operational activities prior to their uplink transmission.
Mouse	A pointing device that is used along with a keyboard in point-and-click user interfaces. The mouse used with HOSC work-stations contains three mouse buttons. The left mouse button is used to activate and select items on windows. The middle mouse button is used for move functions. The right mouse button is used to access popup menus.
MSID Text Field	An output object for viewing telemetry containing a label for the telemetry parameter, as well as the current value of the parameter displayed in a specified format (i.e., decimal, hex, octal, binary, American Standard Code for Information Interchange (ASCII), etc.).
Multiple Drawing Mode	A mode that allows users to draw multiple objects of the same type.
Native Data Type	Defined in the database and indicates how the MSID data will be interpreted in the HOSC.
Nominal	A color code indicating expected conditions within defined limits of parameters.
Non-Shareable	A flag has been set to not allow other users to retrieve your User-generated Data Element (UDE) from the UDE Database and use it on their local workstation.
Normal	A telemetered parameter that occurs once per packet.
Note	A standard icon used throughout the user guide set to direct your attention to specific items of concern.
NRZ-L	Non-Return to Zero - Level. A Pulse Code Modulation (PCM) code in which a digital 'One' is represented by a logic 1 level and a digital 'Zero' is represented by a logic 0 level.
NRZ-M	Non-Return to Zero - Mark. A Pulse Code Modulation (PCM) code in which a digital 'One' is represented by a change in level at the start of a clock cycle and a digital 'Zero' is represented by no change in level at the start of a clock cycle.
OK Pushbutton	A pushbutton that implements any changes specified within a dialog box. The dialog box is dismissed after this pushbutton has been selected.

Option Menu Button	A pushbutton which, when clicked, displays a menu of related options. The selected option is shown as the pushbutton label.
Output Slider	An object that displays telemetry parameters.
Packet	A data unit comprised of octets that a source application generates.
Parameter Composition	Describes how the bits of a parameter can be arranged in a packet for a sample(s) of that parameter.
Pixmap Object	A picture that can be either drawn using the pixmap editor, or scanned and assigned using the pixmap editor.
Playback	Playback data can originate either internally or from some other facility. Project servers in the HOSC receive Playback telemetry streams from the HOSC Data Distribution System (DDS) and perform the same processing as would be performed on real-time telemetry streams.
Pointer	Sometimes called the mouse cursor, the pointer shows the location of the mouse on the desktop. The pointer's shape depends on its mode. (e.g., on a window frame, the pointer is an arrowhead, while you are waiting for an action to complete, the pointer becomes clock).
Point Pair Calibration	A measurement which is calibrated using a series of linear segments. The linear segments are defined by a pair of points for each segment. Each point consists of a raw count value and a corresponding engineering unit value.
Pointer Shapes	A graphical shape that a pointer assumes in the drawing mode (e.g., cross-hairs, I-beams, hour-glasses, etc.).
Polynomial Coefficient Calibration	A measurement is calibrated using the following polynomial calibration equation: where: eu - engineering units cnts - counts $eu = COEF0 + (cnts1 \times COEF1) + (cnts2 \times COEF2) + (cnts3 \times COEF3) + (cnts4 \times COEF4) + (cnts5 \times COEF5) + (cnts6 \times COEF6) + (cnts7 \times COEF7) + (cnts8 \times COEF8) + (cnts9 \times COEF9)$.
Popup Menu	A menu that is invoked when the right mouse button is clicked. Functions available are the most common and vary from application to application.
Predefined Commands	Commands completely defined prior to an operational activity. Predefined commands contain no modifiable data fields.
Pre-released Database	A database that has been validated for operational testing. It is used to validate UDEs (e.g., displays, comps, etc.) prior to the baseline release of the database.

Project Telemetry Database	Contained within the Telemetry Database, includes the telemetry definitions needed to drive HOSC telemetry processing for a specific project/mission. The source of the real-time telemetry processing tables found in the Telemetry Local Table identified by a project/mission/revision prefix. Also included are tables to contain user copy data, an error log, and an Initial Load Table.
Protocol	Provides the formulas for passing messages, specifies the details of message formats, and describes how to handle error conditions. More important, it allows us to discuss communication standards independent of any particular vendor's network hardware. A communication protocol allows one to specify or understand data communication without depending on detailed knowledge of a particular vendor's network hardware.
Pseudo MSID/Parameter	A parameter identification (ID) that has been assigned to contain the output from a computation.
Pseudo Packet	A telemetry packet consisting of external pseudo MSIDs. External pseudo MSIDs are generated (either by EHS computations or scripts), packetized, and multicast on the project LAN.
Pulldown Menu	A list or menu of possible options that is hidden under a general phrase and invoked by clicking the left mouse button.
Pushbutton	A control that causes an immediate action. To press a pushbutton on the screen, point to it and click the left mouse button.
Radiobuttons	A group of buttons that allows users to make only one selection at a time. Radiobuttons are small diamond-shaped buttons.
Range-dependent	A parameter whose occurrence in telemetry is dependent on the value of a range parameter.
Real-time Data	Real-time data are data telemetered to the HOSC and distributed for immediate use. Real-time telemetry data, received into the HOSC system and written to the NRT log, are indexed by its time stamps and other identifying information. When an NRT request is submitted that covers a particular time slice, this indexing information is used to meet that request.
Recall Text	Area within an application that allows users to input up to 256 characters.
Release	In PIMS, an action taken by the manager of a document or request that releases it from the baselined state back into the development state for modifications.

Resize Borders	The area that surrounds the framed area of an application, and is used to change the height or width of the window.
Resize Handles	Up to eight handles surrounding an object that allows users to resize objects, displays, or windows.
Review	In PIMS, the second state of the review cycle in which the document, change request, or data request has been written and submitted for review and approval.
Sample Composition	Describes how the samples of a parameter are arranged in a major frame.
Scatter Plot	A plot that uses unconnected dots to represent the relationships among telemetry values.
Scratchpad Line (SPL) Directives	Provides users with the capability to start and stop displays, computations, and scripts. A user may also uplink and modify commands and update pseudo MSIDs through the use of SPL directives.
Script	A file containing a sequence of directives that can be invoked in a single step.
Scroll Bar	A control that allows the contents of a window area to be displayed without resizing a window or list.
Select Button	The mouse button used for most operations. By default the select button is the left mouse button.
Set Pushbutton	A pushbutton that allows a user to implement changes based on selections made within a dialog box. Reacts like the OK pushbutton and closes the dialog box.
Setup Message Area	The dialog box that allows users to change the number of lines displayed within the message area of the application main window.
Shareable	A flag has been set to allow other users to retrieve your UDE from the UDE Database and use it on their local workstation.
Shotgun	Parameter composition when the bits of a parameter are scattered in multiple non-contiguous words of a major frame.
Slider Box	A graphical component of the scroll bar, which is dragged to provide a different view of the same file, list, or text area.
State Code Calibration	A measurement is converted to a text state code.
Static Object	A graphical object that is not receiving telemetry data.
Status Bar	A feature that allows the viewing of application critical configurations within the main window.
Submit	In PIMS, an action taken by the manager of a document, change request or data request in which the document or request is placed in a state of review and approval and released from development.

Subset	A collection of measurements from the total measurement set that is bounded as an integer number of octets but does not constitute the packet itself. A mini-packet.
Super	A parameter that occurs more than once per packet.
Superseded Database	If a baselined database already exists for a project and mission, before a new baselined database can be released, the current baselined database is designated as superseded.
Switch MSID	A parameter whose value determines which limit or calibration set will be used for the specified MSID.
TDM	Time Division Multiplexed - a technique for transmitting multiple parameters within a single serial bit stream by interleaving them, one after the other.
Time Indicator	Indicates that a group will be activated based on a defined start time and deactivated based on a defined stop time.
Time Plot	A plot against time containing up to four Y-Axis parameters.
Time Reference	A time format that is represented in either GMT or Mission Elapsed Time (MET).
Time Tag	A time reference marking an event. For example, a parameter goes out-of-limits at 230:16:00:00. The time tag for the out-of-limit event is 230:16:00:00.
Tip	A standard icon used within the HOSC user guide set to indicate that suggestions or hints are provided.
Togglebuttons	Small buttons that can be switched "on" or "off." To switch a togglebutton, point to it and click the select button. Black indicates that the desired attribute is in effect or "on."
Tolerance	Number of times the MSID exceeds the limit value before an EM warning message is issued.
Typical	Parameter composition when the bits of a parameter are contiguous.
Unprocessed	Raw telemetry data.
User-generated Data Element (UDE)	A user-generated file. For example, a display, script, computation, pixmap, etc., is a UDE.
Warning Limits	A color code (red) representing limit violations of a parameter.

Wildcard	Placeholders for other characters in a string. Three wildcards are permitted in most HOSC applications. The "*" which represents any combination of characters, and the "?" which represents any single character. A blank can be used to replace a single "*" to indicate "all". Database applications use Oracle as their basis and therefore "%" is used like the "*" and an underscore character "_" is used like the "?". Blank operates the same in database applications as other HOSC applications and represents "all."
Window Menu	The menu that appears when you press the window menu button, which is located to the left of the application title bar on a window frame. Every window has a system menu that enables you to control the position of the window.
Workspace	The area on a terminal where the windows of a user's environment appear. The workspace is sometimes referred to as a desktop or root window.
XY Plot	A plot that contains one X-Axis and up to four Y- Axes parameters.